CHAPTER 1

Introduction

Estuaries and coasts are among America's most valuable resources, providing a wide range of services that benefit humans and other species. However, like so many natural environments, estuaries and coastal habitats have been stressed and degraded by decades of human use and development. As our population continues to be drawn to coastal areas, we struggle to find ways to preserve and restore the qualities that attract us. Habitat restoration offers great promise for reversing the trend of lost and degraded habitat functions. Citizen's groups, private organizations, universities and governments are already conducting restoration activities throughout the nation. While there are countless examples of successful restoration, it has become apparent that we are not keeping up with the rate of habitat degradation and loss. We need to develop a strategic approach to refocus our human and financial resources to establish priorities, set realistic expectations and work together to achieve greater benefits.

In response to this need, a collaboration of scientists, community leaders, organizations, and government at all levels built on previous efforts to produce *A National Strategy to Restore Coastal and Estuarine Habitat.* The Strategy serves to coordinate the various federal and non-federal coastal and estuarine habitat restoration efforts, to provide a comprehensive approach to project implementation, and to encourage partnerships for new restoration efforts. This document supplies an approach to restoring function to estuarine and coastal habitat; provides guidance on planning, selecting, and implementing restoration projects; and describes the status of restoration planning around the country. By implementing the approach provided here, we can recover and sustain the benefits that estuaries and coasts provide for us all.

Estuaries and Coastal Habitat

Estuaries are the vibrant zones where rivers mix with the sea. This mixing of freshwater and saltwater creates a mosaic of habitat types, from mangroves and forest-fringed marshes to seagrass meadows and brackish sloughs. These connected coastal ecosystems work together to support a remarkable diversity of flora and fauna and provide a myriad of other services and functions.

Coastal habitats provide an indispensable part of the nation's significant natural resources and sustain much of its economy. These habitats, from the headwaters of rivers to the open ocean, are linked biologically, chemically and physically.

For the purposes of this document, coastal and estuarine habitat includes the Great Lakes, which contain many estuarine-like habitats. When the term "estuary" is used here, it generally refers to the geographic area between the head of tide and the downstream terminus structure. Estuarine watersheds are divided into sub-watersheds, which extend upstream to the headwaters of the system. The term "region" is used to denote a larger or multi-state area identified for purposes of restoration planning. "Restoration" is defined here as the manipulation of the physical, chemical or biological characteristics of a site with the goal of returning self-sustaining natural or historic structure and functions to former or degraded habitat.

Services Provided by Estuarine and Coastal Habitat

Estuaries and coastal areas are home to many ports and industrial areas and the communities that depend on them. They vary in nature from the extensive sounds of North Carolina to the urbanized shores of the San Francisco Bay, but all play vital roles in supporting our nation's economy and the well-being of local citizens. In addition to providing access to maritime trade, essential habitat for fisheries and recreational opportunities, estuaries improve water quality and serve as buffers for coastal upland property.

Estuaries are among the earth's most productive natural systems. The nation's estuarine and coastal waters provide critical habitat for various life stages of commercial fish and shellfish. Habitats such as marshes and mangroves provide refuge, forage and reproductive opportunities for fishes, crustaceans, wading birds and a variety of mammals. Estuaries are essential for the survival and reproduction of many species of fish, shellfish and seagrasses. Shallow ponds and seed-producing vegetation are used by millions of migratory waterfowl every winter. Riparian forests are vital habitat for birds, fish and other wildlife.

Healthy estuaries and coastal areas help maintain clean water. Healthy and intact tidal wetlands significantly improve water quality by storing and filtering sediments, and assimilating or trapping nutrients which are taken up by wetland plants. Without wetlands, no filter would exist for water making its way from the nation's rivers and tributaries to the oceans.

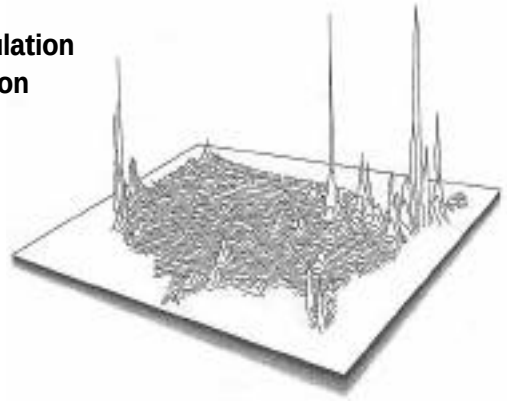
Coastal and estuarine habitats protect local communities from flooding, either by damping storm surges from the ocean or providing storage for floodwaters coming downriver. In addition, riparian and wetland vegetation stabilize shorelines and prevent erosion.

Healthy estuary habitats make an important contribution to local and national economies through tourism, commercial and recreational fishing, aquaculture and other income-producing business sectors. With careful stewardship, these benefits for humans and wildlife can continue from generation to generation.

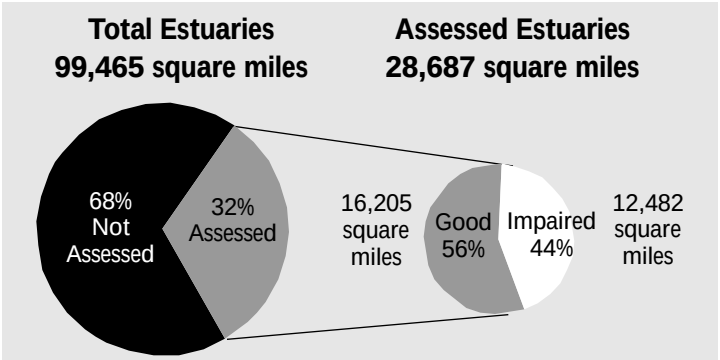
The Need for Coastal and Estuarine Habitat Restoration

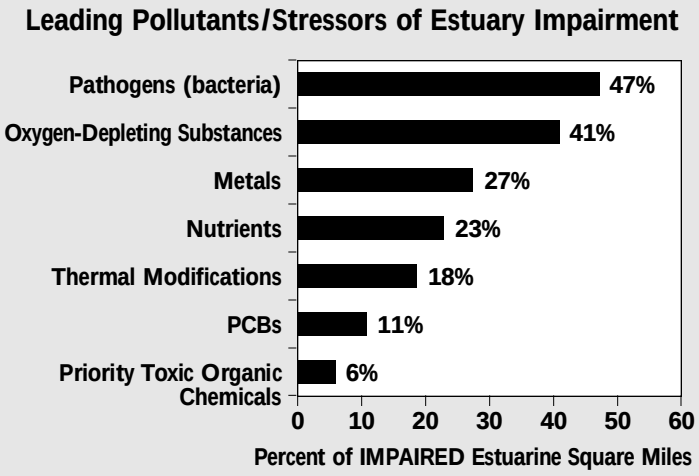
The coastal population of the United States is currently growing faster than the nation's overall population, a trend that is projected to continue. People are flocking to our shorelines, putting more pressures on estuarine and coastal habitat while requiring more ecosystem services from them. Coastal counties make up only 11 percent of the land area in the lower 48 states, but density in coastal counties is nearly five times that in the rest of the country. By 2010, 75 percent of the United States population is expected to live within 50 miles of the coast.

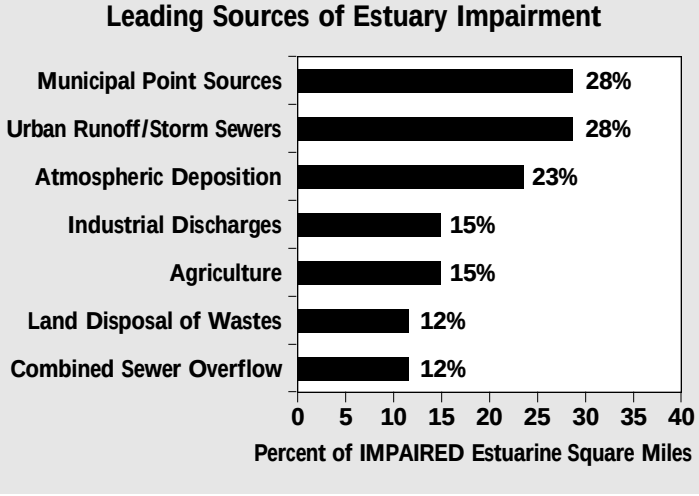
U.S. Population Distribution



National Oceanic and Atmospheric Administration, 1990. 50 Years of Population Change Along the Nation's Coasts, 1960-2010.







Good water quality is imperative for human health and for the proper functioning of the wetlands, marshes and riparian areas that make up the nation's coasts and estuaries. Impaired water quality can alter or destroy the intricate balance within these ecosystems. Direct impacts of polluted waters on estuarine organisms include the clogging of gills and filter-feeding organs by suspended solids, impaired growth and reproduction and the bioaccumulation of toxic contaminants up the food chain, concentrating in top predator species and human food. Indirect impacts include eutrophication due to excess nutrients that can result in low dissolved oxygen, fish kills, algal blooms and limiting growth of seagrasses. In addition, waterborne pathogens and toxic algal blooms routinely infect commercially valuable shellfish beds, resulting in threatened human health and lost revenue.

Another major threat to coastal and estuarine habitat is direct alteration. Scientists estimate that the nation has lost more than half the wetland area in the lower 48 states between the 1600s and the present (Mitch and Gosselink, 1993). National Estuary Programs consistently identify direct alteration of habitat as a high-priority concern. In most cases, degradation and loss in each of the nation's estuaries results from an accumulation of small development activities. Collectively, actions such

as dredging and/or filling for development, mineral extraction, altering hydrologic connections by diking or installing tide-gates or dams, paving, runoff, sewage discharges, subsidence and erosion are affecting coastal areas.

Estuarine habitat restoration is required for ecological, cultural and aesthetic reasons, but also for the benefits that directly relate to the everyday existence of United States citizens. Restoring their functions will not only preserve our ecological heritage, but will financially sustain the nation by allowing economic activities that depend on healthy coastal environments to continue. A healthy economy is dependent on healthy estuarine habitats and the good water quality these habitats provide and require. We must find ways to restore habitat that has been lost and degraded.

Relationship to other Efforts

A National Strategy builds on previous efforts to organize and improve restoration of coastal and estuarine habitat. For example, working together in a year-long effort, Restore America's Estuaries and the Estuarine Research Federation developed a set of principles to guide national estuarine habitat restoration. Through a series of workshops, scientists, managers and practitioners from federal, state and local governments, academic institutions, nongovernmental organizations and the private sector reached consensus on the formulation of restoration principles. A set of fourteen comprehensive principles to guide habitat restoration was adopted in 1999.

The Principles of Estuarine Habitat Restoration (see page 10) created a foundation for the development of a national restoration strategy. The principles provide guidance useful in restoration research, community-based restoration, mitigation driven by regulatory requirements and projects funded by federal, state and local government agencies.

Many coastal states and regional organizations have effective restoration programs. Under the Coastal Zone Management Act, states conduct coastal planning, which often includes restoration of coastal and estuarine habitat. Regional organizations in the San Francisco Bay area, the Chesapeake Bay area, the Great Lakes region, and other areas have developed restoration programs. Also, a number of federal agencies are working with public and private partners at the state and local levels on projects that will restore estuarine habitat.

- **U.S. Department of the Interior, Fish and Wildlife Service**
  Since 1994, the United States Fish and Wildlife Service's Coastal Program has worked with its partners in 15 priority coastal watersheds to restore 100,000 acres of wetlands and uplands; protect 1,000,000 acres of coastal habitats; re-open 3,330 miles of stream for anadromous fish; and restore 800 miles of riparian corridor.

- **U.S. Department of Agriculture**
  The United States Department of Agriculture's Wetland Reserve Program encourages voluntary wetland preservation and rehabilitation on agricultural land. The program has enrolled 5,000 subscribers, with many more waiting to participate.

- **U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)**
  NOAA has a number of coastal and estuarine restoration programs. The Damage Assessment Restoration Program rehabilitates coastal habitat affected by waste sites, oil or hazardous material spills or vessel groundings. The Coastal Protection and Restoration Program improves and restores habitat affected by contaminated sediments and waste sites. The Community-Based Restoration Program implements local, state, and regional restoration projects and partnerships. The National Estuarine Research Reserve Program establishes protected areas in cooperation with states. The Marine Sanctuary Program manages and restores marine protected areas, and the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) program addresses wetland loss in Louisiana. The National Sea Grant program funds research and provides extension agents that specialize in habitat restoration. NOAA programs are involved in the restoration of more than 500 sites nationwide.

- **Environmental Protection Agency**
  More than 300,000 acres have been restored through the Environmental Protection Agency's National Estuary Program. Through this program, restoration is implemented by a variety of partners at the state and local level with program assistance in stakeholder coordination, technical expertise, project funding and other activities to facilitate the process.

- **U.S. Department of Defense, Army Corps of Engineers**
  The United States Army Corps of Engineers (Corps) has several authorities that may be used to restore estuaries. These include individually authorized studies, beneficial use of dredged material related to operation of navigation channels, and several programmatic authorities. Some examples of the types of estuary restoration activities the Corps is involved with include installation of fish ladders, dam removal, restoration of tidal flows to previously used dispos-

Principles of Estuarine Habitat Restoration

Context

Principle #1: Preservation and enhancement of existing habitat are critical to the success of estuarine habitat restoration.

Principle #2: Estuaries can be restored only by using a long-term stewardship approach and developing the constituencies, policies and funding needed to support this.

Principle #3: The size, scale and amount of restoration activity must increase substantially to have a significant effect on over-all estuarine functioning and health.

Principle #4: Greater public awareness, understanding and involvement in estuarine habitat restoration are necessary to the success of individual projects and achieving national restoration goals.

Planning

Principle #5: Restoration plans should be developed at the estuary level to set a broad vision, articulate clear goals, and integrate an ecosystem perspective.

Principle #6: Estuarine restoration plans should be developed through open regional processes that incorporate all key stakeholders and the best scientific thinking available.

Project Design

Principle #7: Project goals should be clearly stated, site specific, measurable and long-term (in many cases greater than 20 years).

Principle #8: Success criteria for projects need to include both functional and structural elements and be linked to healthy, local reference habitats.

Principle #9: Site plans need to address off-site considerations like potential flooding, salt water intrusion into wells, and damage to existing septic systems, to be sure projects do not have negative impacts on nearby people and property.

Principle #10: Scientifically based monitoring is essential to the effectiveness of restoration projects and over-all estuarine restoration.

Implementation

Principle #11: Engineering practices should be applied using all available ecological knowledge, maximizing the use of natural processes to achieve goals.

Principle #12: Adaptive management should be employed at as many restored sites as possible, so they continue to move toward desired endpoints and self-sustainability wherever possible.

Principle #13: Long-term site protection is essential to effective estuarine habitat restoration.

Principle #14: Public access to restoration sites should be encouraged wherever appropriate, but designed to minimize impacts on the ecological functioning of the site.

al areas, and restoration with dredged materials. Activities cover a number of geographic areas, including restoration on Grand Terre Island in Louisiana's Barataria Bay Waterway and the removal of Smelt Hill Dam in Maine's Penobscot Bay estuary.

The Corps also serves as the chair of the CWPPRA interagency task force. CWPPRA was passed in 1990 in response to severe and rapid loss of wetlands in the State of Louisiana. The CWPPRA program specializes in designing large-scale projects that reverse wetland loss and provide future protection for Louisiana's threatened coastline. Under CWPPRA, federal agencies and the state of Louisiana design, develop and implement diverse projects to protect, create and restore wetlands threatened by erosion, subsidence and hydrological alterations.

In November 2000, following the progress made by the *Principles of Estuarine Habitat Restoration* and by various federal, state, local and nongovernmental activities, the Estuary Restoration Act of 2000 was signed into law. This law, originally sponsored by the late Senator John Chafee of Rhode Island and Represen-

tative Wayne Gilchrest of Maryland, encourages the restoration of estuarine habitats through enhanced coordination of federal and non-federal efforts and financing of efficient and innovative local, state and regional projects. Subject to annual appropriations by Congress, the legislation authorizes $275 million over five years to implement a comprehensive approach that will call upon public-private partnerships to reverse the deterioration of estuaries by restoring degraded habitat.

Conservation and restoration of coastal and estuarine habitat also is of international interest. Several regions of the U.S. are collaborating with their Canadian and Mexican neighbors to restore coastal areas that span borders. Examples of successful international cooperation to restore habitat can be found in the Gulf of Maine, the Great Lakes and southern California. On a global scale, the United Nations Development Program's Water Strategy, a Strategic Initiative for Ocean and Coastal Management calls for international cooperation in managing freshwater and coastal systems. The program is documenting best management practices and lessons learned with the intent of integrating coastal management and sustaining coastal resources. Since the prosperity of people who live in the coastal zone is dependent on the quality of coastal and ocean management, investing in healthy coastal habitats will produce global benefits.

CONTENTS OF *A NATIONAL STRATEGY*

A National Strategy is comprised of three primary components: objectives, a framework for implementation and regional analyses of restoration planning. Together, these components will advance the nation's efforts to restore estuarine habitat on a broad and coordinated scale.

Additionally, a web site for this national strategy has been established to serve as a public interface. The web site (http://restoration.nos.noaa.gov) provides an inventory of existing restoration plans, a searchable database of funding opportunities related to habitat restoration projects and other tools to assist estuarine habitat restoration practitioners and decision-makers across the nation.

Objectives

This section of *A National Strategy* presents objectives to restore function to coastal and estuarine habitat. These objectives will be useful in meeting the goal of the strategy required by the Estuary Restoration Act to restore one million acres of estuary habitat by 2010, and will also be valuable for the implementation of other restoration programs and projects. These objectives are presented to encourage projects that benefit coastal and estuarine habitats and species; create and maintain effective partnerships; set restoration priorities and conduct restoration planning; apply the best science and technology; monitor and evaluate habitat restoration efforts; increase public awareness of coastal and estuarine restoration issues; and obtain sufficient funding to restore function to coastal and estuarine habitat.

Framework for Implementation

This section of *A National Strategy* provides a framework for planning and prioritizing coastal and estuarine habitat restoration. It provides planners and practitioners with a framework for comprehensive and inclusive planning to identify restoration needs and opportunities on the watershed, estuary or regional level. Information is provided to assist with establishing restoration priorities, designing scientifically sound projects, and implementing plans and selecting projects that contribute to the goals of estuary or regional plans.

Regional Analyses of Restoration Planning

Analyses of existing estuarine habitat restoration plans have been developed for six regions within the United States.

COASTAL REGIONS	STATES
Northeast Atlantic	Maine, N.H., Mass., R.I., Conn., N.Y., N.J., Del., Md., Va.
Southeast Atlantic	N.C., S.C., Ga., Fla. (including south Florida, the Everglades, Florida Bay and the Florida Keys), Puerto Rico, U.S. Virgin Islands
Gulf of Mexico	The Gulf Coast of Florida (excluding the Everglades, Florida Bay and the Florida Keys), Miss., Ala., La., Tex.
California and the Pacific Islands	Calif., Hawaii, Pacific Protectorates
Northwest Pacific	Ore., Wash., and Alaska
Great Lakes	Minn., Mich., Wis., Ind., Ill., Ohio, N.Y.

Each regional analysis includes:

- information on original acreage and acres lost, conserved, preserved and restored;
- key habitats and species in need of protection and restoration such as wetlands, marsh, riparian areas and various fish species;
- key threats to habitats and species of concern such as subsidence, filling, draining and invasive species;

- restoration goals such as protection of fish and wildlife habitat, and improvement of water quality;
- successful restoration methods and techniques such as restoring tidal flow and planting vegetation;
- key elements of successful restoration planning efforts in the region such as site selection criteria, reference sites, adaptive management and funding strategies; and
- needs for further research and development for restoration, such as project evaluation and success criteria, and methods for beach renourishment and beneficial use of dredged material.

Expected Outcome

Although estuarine and coastal habitats are threatened by and under stress from a variety of human activities, a strategic coordinated response to the problems of habitat loss and degradation has been developed. As a nation, we stand ready to build on our previous restoration successes and take advantage of the tremendous energy offered by volunteers in coastal communities, the promise of recent scientific advances, newly developed technical abilities of the private sector and coordinated planning emerging from government at all levels.

By applying the approach outlined in *A National Strategy*, we can focus our ongoing efforts more efficiently and plan for more effective future restoration programs. Working together, we can balance human and ecological needs and achieve sustainable, productive and diverse coastal and estuarine habitats for future generations.

References

Mitsch, W.J., J.G. Gosslink. 1993. *Wetlands.* 2nd Edition. Van Nostrand Reinhold. New York.